

Integrated Geochemistry and Basin Modeling Study of the Bakken Formation, Williston Basin, USA

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The Bakken formation has been described as a tight, continuous, unconventional shale oil play. Integration of stratigraphy, geochemistry and basin modeling demonstrates the Bakken petroleum system is conventional, containing all of the essential elements of a conventional petroleum system, but not all of the qualities that lead to high production rates, and high well EUR's. Poor reservoir quality of the middle Bakken reservoir unit plays a significant role with respect to producibility. Understanding the geology and controls on reservoir quality and distribution are essential for prospecting in the Bakken.

The geochemistry of Bakken oils has been investigated to gain insight into processes controlling petroleum distribution within the Bakken petroleum system. Initial results indicate petroleum migration is a significant process. The oils being produced from the middle member of the Bakken are derived from the Bakken shale. From oil biomarker data, variable source rock facies are interpreted.

Basin modeling was performed to constrain petroleum generation and migration timing. The modeled temperatures and maturity indicators of the constructed basin model fit independent maturity markers as the source rock transformation or triaromatic steranes ratio. The model further gives support to the existence of a heat flow anomaly that has been discussed controversially in earlier publications. With the available kinetic data it was possible to calculate first hydrocarbon composition predictions that are in agreement with average production data. Expulsion from the source rock and migration plays a crucial role when assessing the volumes and composition of hydrocarbons in place in low permeability reservoirs. As part of an ongoing study, the impact of different influences like over-pressure, fracture opening and closing and related possible maturity trapping will be tested to determine their order of impact on the accumulation of hydrocarbons in the Bakken petroleum system.